THE WEATHER AND CIRCULATION OF SEPTEMBER 1955[1]

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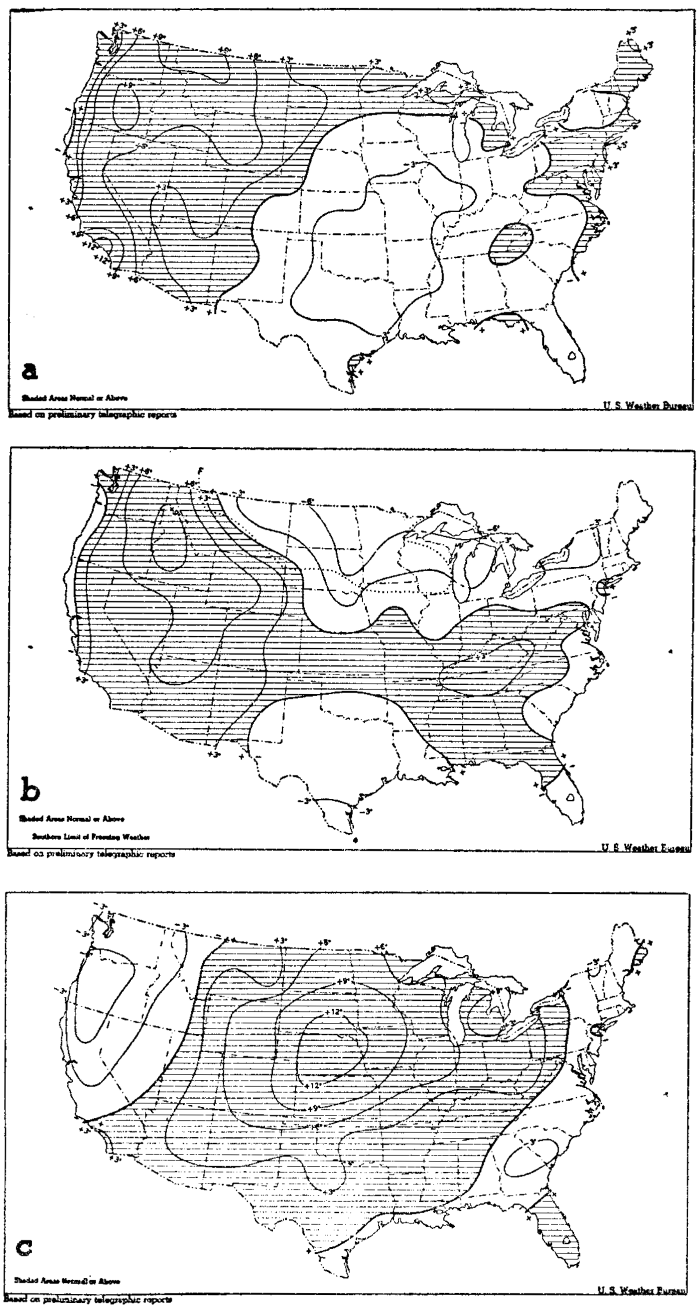
1. WEATHER AND CIRCULATION OVER THE UNITED STATES

During September 1955 surface temperature anomalies over the United States underwent a complete reversal (fig. 1). Early in the month (fig. 1a) temperatures averaged above normal in the North and West and below normal in southern and central portions. Within this

[1] See Charts I-XV following p. 215 for analyzed climatological data for the month.



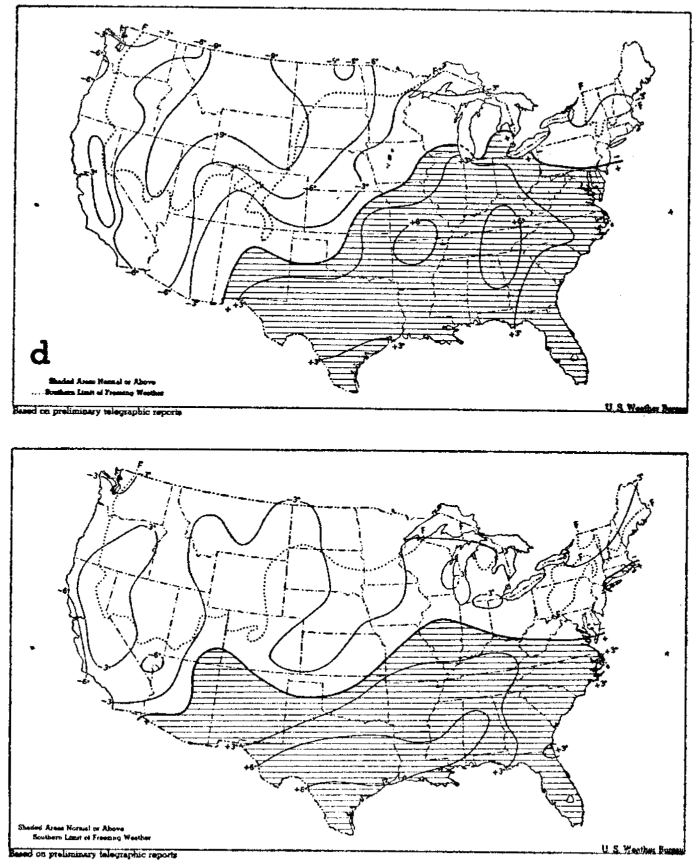


FIGURE 1.—Departure of average temperature (°F.) from normal for weeks ending (a) September 4, (b) September 11, (c) September 18, (d) September 25, and (e) October 2, 1955. Cold replaced heat as the trough established itself in the West.

period the West experienced a particularly intense heat wave with temperature readings ranging as high as 110° F. at Los Angeles, 111° F. at Red Bluff, Calif., and 107° F. at Medford, Oreg. At Los Angeles, beginning with August 31, over 100° readings continued for 8 successive days, setting a record for September heat. This heat moderated by the middle of the month (fig. 1c) and temperatures even became subnormal, while 100° readings now appeared briefly in the central part of the country as far north as Pierre, S. Dak. Later this month a warming trend occurred in the Southeast, accompanied by marked cooling in the North and West (fig. 1d and e). It was within this period that Jackson, Miss., after 3 months of below normal temperatures, experienced its highest temperature of the year, 97° F., on September 20.

These temperature changes accompanied a readjustment in the long wave pattern over North America, as is seen from figure 2A and B. The first half of the month was characterized by a ridge and above normal 700-mb. heights in the West and a weak trough in the East. As pointed out frequently in past articles of this series, such conditions usually accompany above normal temperatures in the West. The easterly anomalous flow in the Southwest further contributed to heating due to compression of the air as it descended the mountains into California, resulting in the abnormally high temperatures referred to above.

The latter half-month witnessed the establishment of a diametrically opposite pattern across the continent (fig. 2B). The ridge in the West gave way to a trough, with heights as far below normal as they had been above earlier in the month. The weak trough in the East similarly was replaced by a ridge. As this pattern came into being below normal temperatures occurred in the West and above normal in the Southeast (fig. 1d).

This circulation change accompanied a southward shift of the westerlies from their abnormal northerly position during August [1] to temperate latitudes in September. This is shown in figure 3, where it is seen that from August to September the westerlies diminished north of 55° N. and increased markedly in midlatitudes. This change occurred near the middle of the month as the zonal westerlies (35°N.–55°N.) reached their maximum value of the month and the polar westerlies were diminishing most rapidly. This southward shift of the strongest westerlies weakened the subtropical ridge in the United States (except for the Southeast) by allowing cooler air masses to penetrate the country (Chart IX).

The distribution of precipitation during the month similarly reflected this change in circulation. The first half of the month produced negligible precipitation amounts, except along the Gulf and South Atlantic coasts. This was a consequence of northerly and northwesterly flow over much of the country, a circulation pattern which has been recognized as characteristic of dry weather over most of the United States during September [2] as well as in the winter season [3, 4]. With the trough development

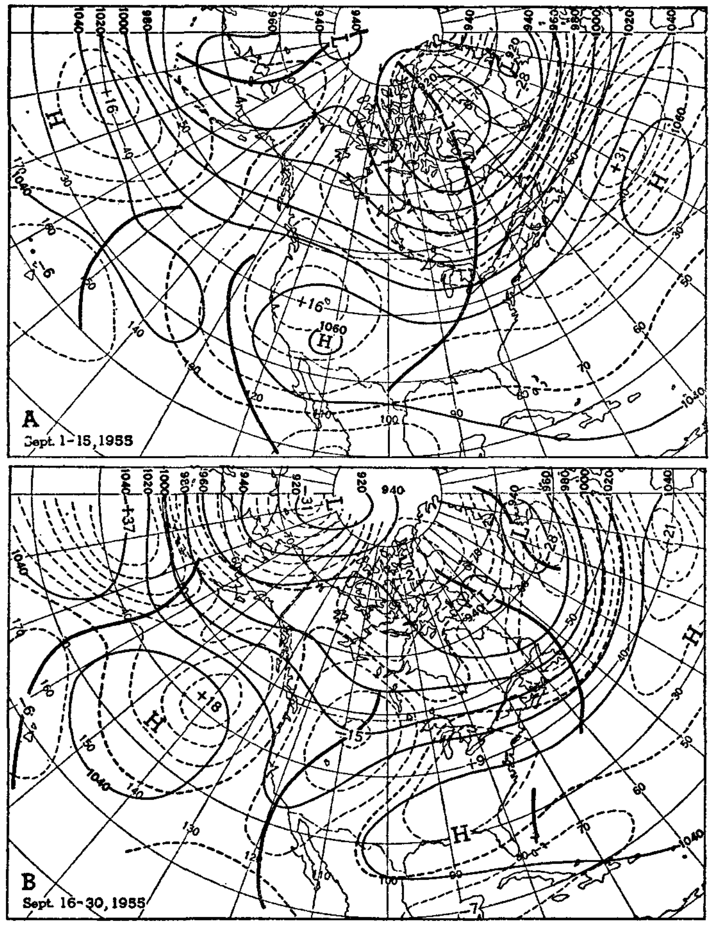


FIGURE 2.—Mean 700-mb. contours for 15-day periods (A) September 1–15, and (B) September 16–30, 1955 with departure from normal superimposed (both in tens of feet). Above normal heights in the West gave way to below normal heights.

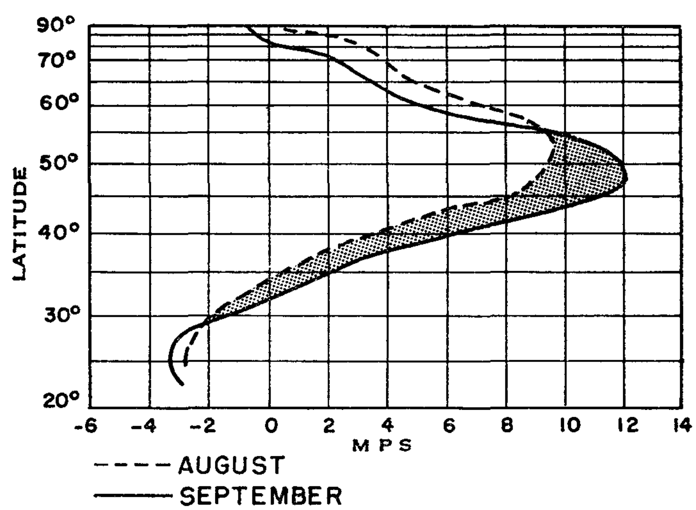


FIGURE 3.—Mean zonal wind speed profile (0° westward to 180°) for September 1955 (solid) and August 1955 (dashed). Latitudes where the zonal wind speed increased over the August values are shaded. Marked increases occurred south of 55° N. latitude with decreases north of this latitude.

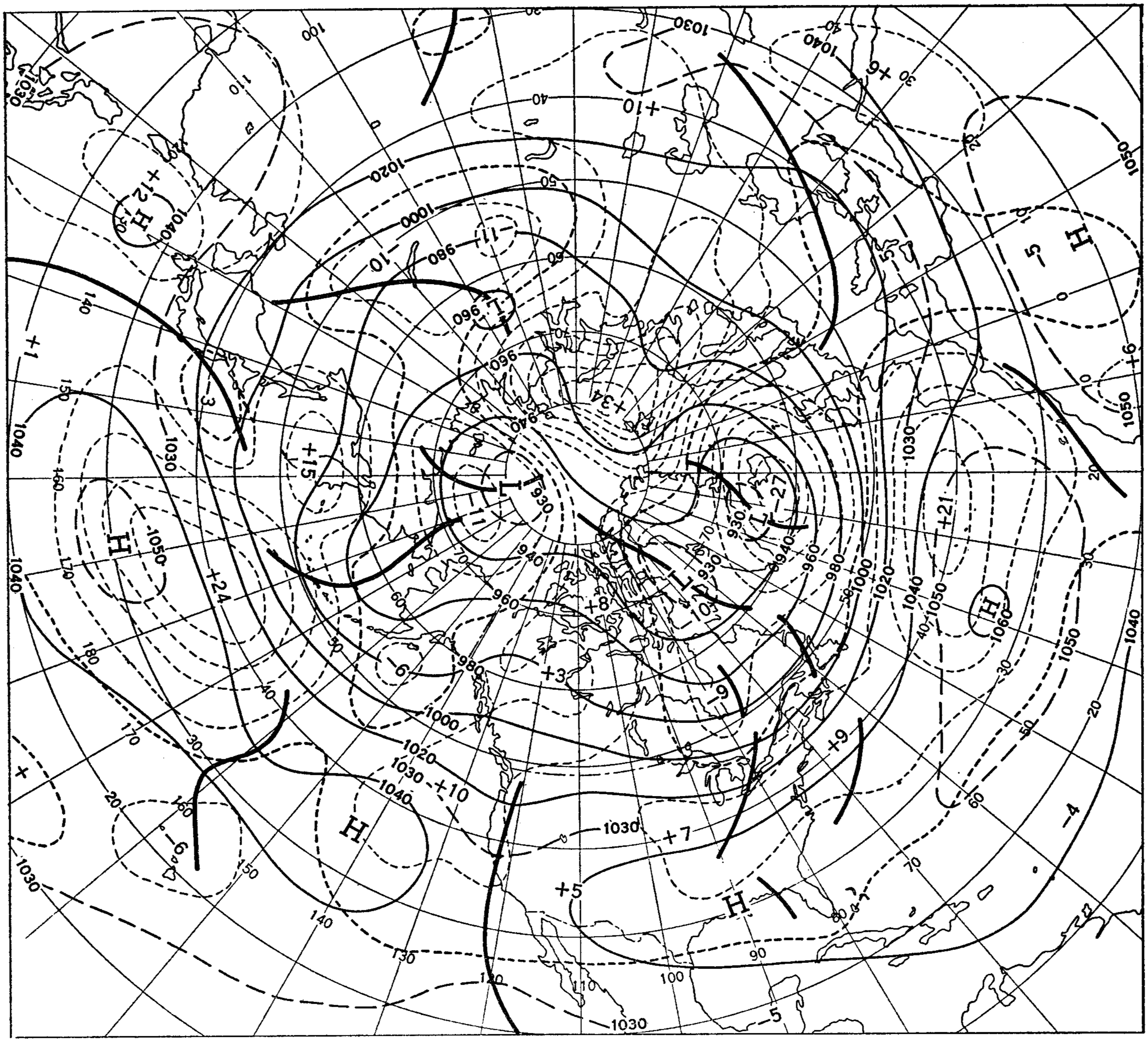


FIGURE 4.—Mean 700-mb. height contours and departures from normal (both in tens of feet) for September 1955. Largest positive height anomalies were associated with the oceanic anticyclones and with blocking north of Scandinavia, while greatest negative anomalies accompanied cyclonic activity near Iceland and in the Arctic. Over North America heights averaged slightly above normal.

in the West later this month, accompanied by pronounced southerly flow through the Central Plains and increased cyclonic activity in the Northern Plains (Chart X), precipitation increased over most of the country except the Southeast. This is indicated from table 1 where the percent of precipitation occurring during the last half of the month is tabulated for a few stations. Many stations in the Plains States received all of their monthly precipitation during the last 15 days. Even in the eastern part of the country, which early in the month lay under cyclonically curved flow aloft, some stations still received as much as 90 percent of their rainfall the last half-month when the flow was anticyclonically curved. The explanation for this lies in the fact that early in the month most of the country, except the southeastern coastal areas, was under the influence of essentially continental and modified Pacific air masses, while later in the month moister air from low latitudes was carried northward and eastward as the trough in the West became established. In the southeastern part of the country some drying out occurred

TABLE 1.—*Percentage of monthly precipitation occurring during last half of September 1955 at selected stations in the United States. Note that the southeastern stations in the right half of table received most of their rainfall in the first half of the month.*

	Percent		*Percent*
Billings, Mont	99	Charleston, S. C	3
Kansas City, Mo	100	Raleigh, N. C	34
Amarillo, Tex	100	Miami, Fla	26
Huntington, W. Va	90	Corpus Christi, Tex	17
Syracuse, N. Y	87	New Orleans, La	17

the latter half-month as anticyclonic conditions set in. Some cities in this region received less than 30 percent of their monthly total during this period (table 1).

The circulation that resulted from averaging of these two regimes is seen in figure 4. Over the United States heights averaged slightly above normal with weak troughs present along the west coast and in the Great Lakes region. Temperatures associated with this mean circulation averaged essentially above normal with a few stations reporting positive departures of as much as 4°F. (Chart I-B). Precipitation amounts were heavier than normal along the Gulf and Carolina coastal areas, which received large amounts from tropical storms, and also in some central sections where local amounts as great as 6 inches occurred (Charts II and III). Subnormal amounts, on the other hand, occurred in the Northern Plains, the Southwest, and within the interior regions of some of the Gulf States under the subtropical ridge. Drought conditions in the Southeast under this subtropical high cell were particularly striking—Birmingham, Ala., for example, with only a trace of rain, experienced its driest September on record and its driest month since October 1924 when no rain occurred at all.

2. HURRICANE ACTIVITY

Six tropical storms, four of hurricane intensity, made their appearance this month in the waters adjacent to the North American coast (Chart X). Of these, three penetrated the Mexican coast, accompanied by torrential rains, high winds, and flooding, and caused considerable loss of life and property damage. These storms traversed the Caribbean parallel to the prevailing easterly flow aloft where 700-mb. heights averaged below normal. This track lay in the region of cyclonic shear to the left of the strongest easterlies, which were stronger than those for August south of 30° N. latitude (fig. 3).

Two hurricanes successfully penetrated the mean subtropical ridge line and emerged into the westerlies farther north. One of these, Ione, entered the United States mainland near Hatteras, causing high winds and tides as well as heavy rains along adjacent coastal areas. However, strengthening westerlies accompanying a southward migration of a cool Canadian air mass swept this storm rapidly out to sea just north of Hatteras, and thus little damage resulted to inland areas. (See article by Jordan and Stowell in this issue for analysis of small-scale features of Ione's track.)

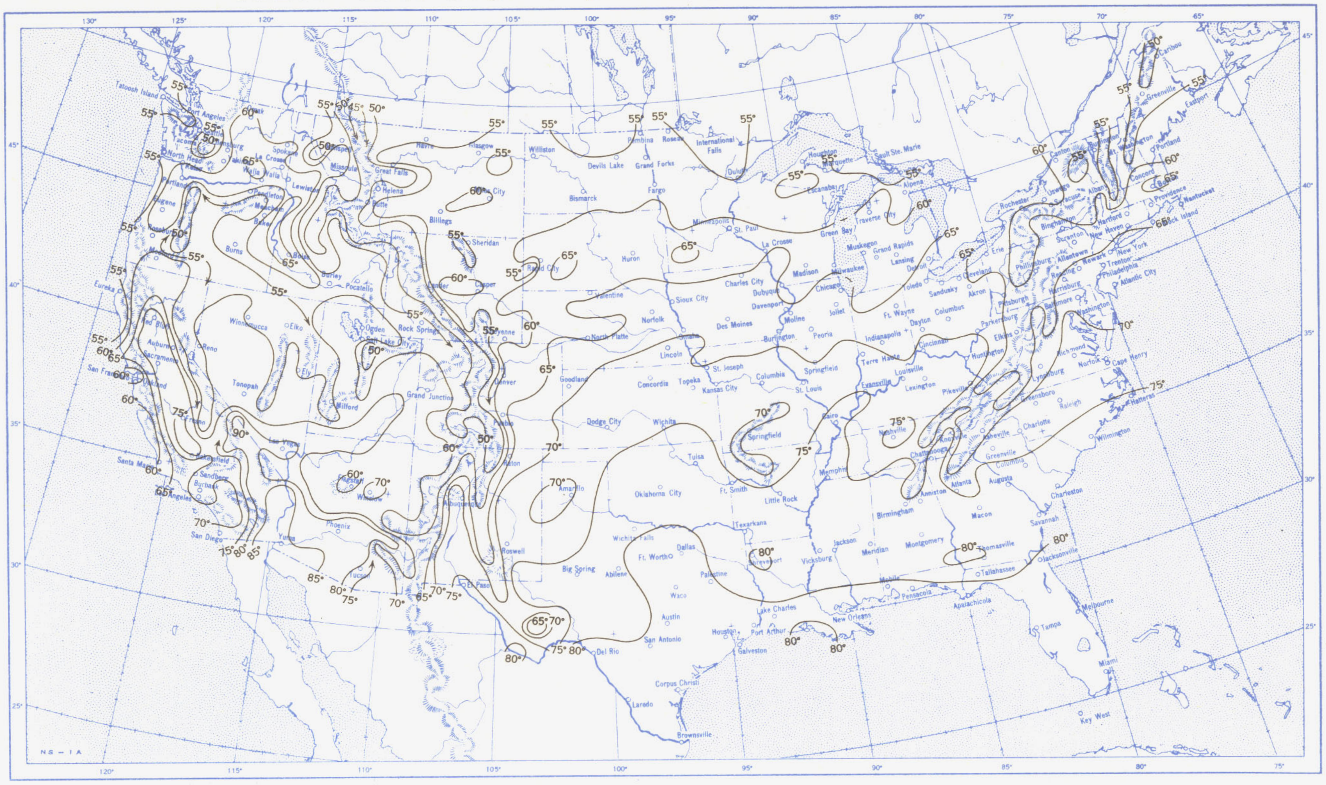
3. CIRCULATION FEATURES OVER THE HEMISPHERE IN GENERAL

The monthly mean circulation (fig. 4) was essentially a high index pattern with well-developed oceanic anticyclones north of their normal latitudes. At high latitudes well-marked cyclonic centers were present in the Arctic and in the vicinity of Greenland and Iceland, while mid-latitude troughs were weaker than normal. In the eastern Atlantic the 700-mb. flow was abnormally strong as indicated by the −270-ft. anomaly north of a +210-ft. anomaly center. This current split at the European coastline with one branch swinging north around an area of blocking activity north of Scandinavia (+340-ft. anomaly center), and another branch passing south across the Mediterranean accompanied, however, by only weak negative heights in this area.

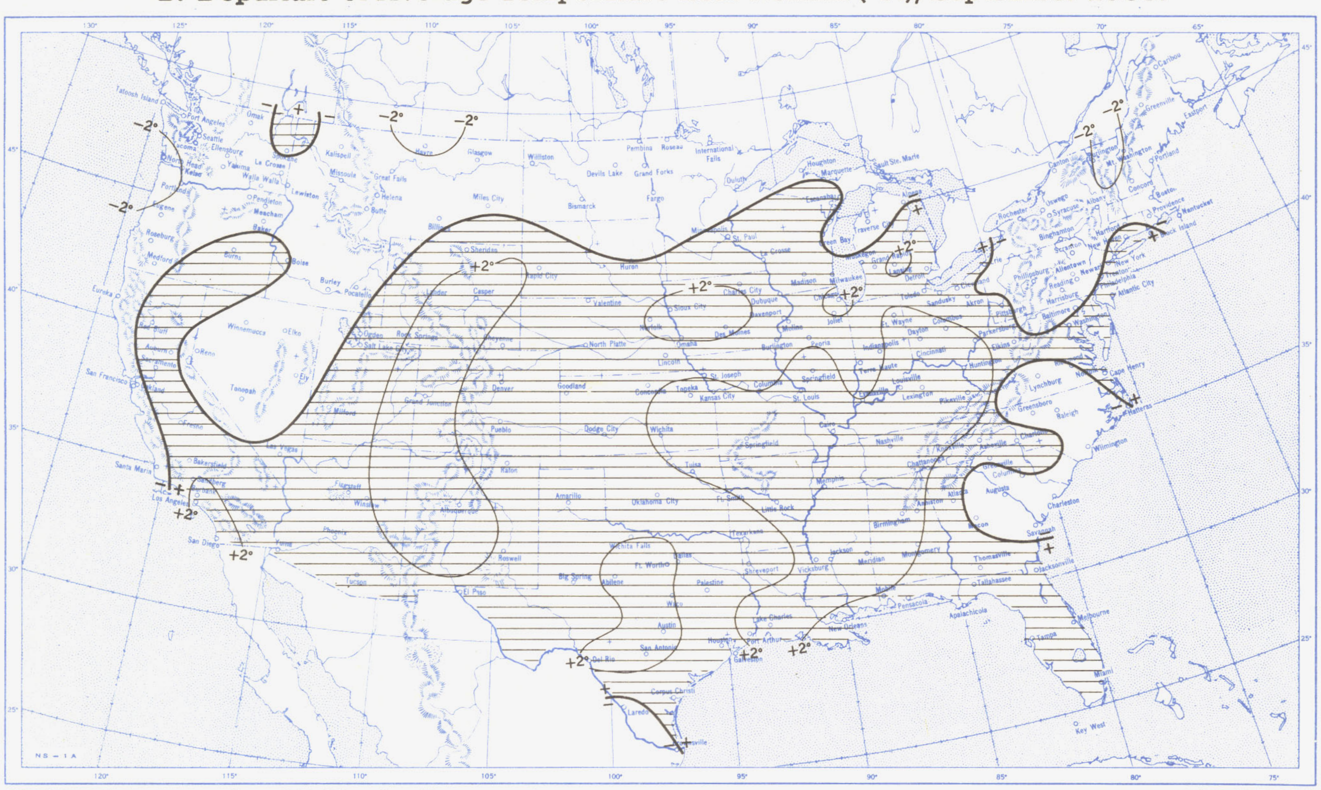
REFERENCES

1. J. Namias and C. R. Dunn, "The Weather and Circulation of August 1955—Including the Climatological Background for Hurricanes Connie and Diane," *Monthly Weather Review*, vol. 83, No. 8, August 1955, pp. 163–170.
2. W. H. Klein, "The Weather and Circulation of September 1953—Another Dry Month in the United States," *Monthly Weather Review*, vol. 81, No. 9, September 1953, pp. 304–308.
3. D. E. Martin and H. F. Hawkins, Jr., "Forecasting the Weather: The Relationship of Temperature and Circulation Aloft," *Weatherwise*, vol. 3, Nos. 4–6, August–December 1950, pp. 89–92, 113–116, 138–141.
4. C. K. Stidd, "The Use of Correlation Fields in Relating Precipitation to Circulation," *Journal of Meteorology*, vol. 11, No. 3, June 1954, pp. 202–213.

Chart I. A. Average Temperature (°F.) at Surface, September 1955.

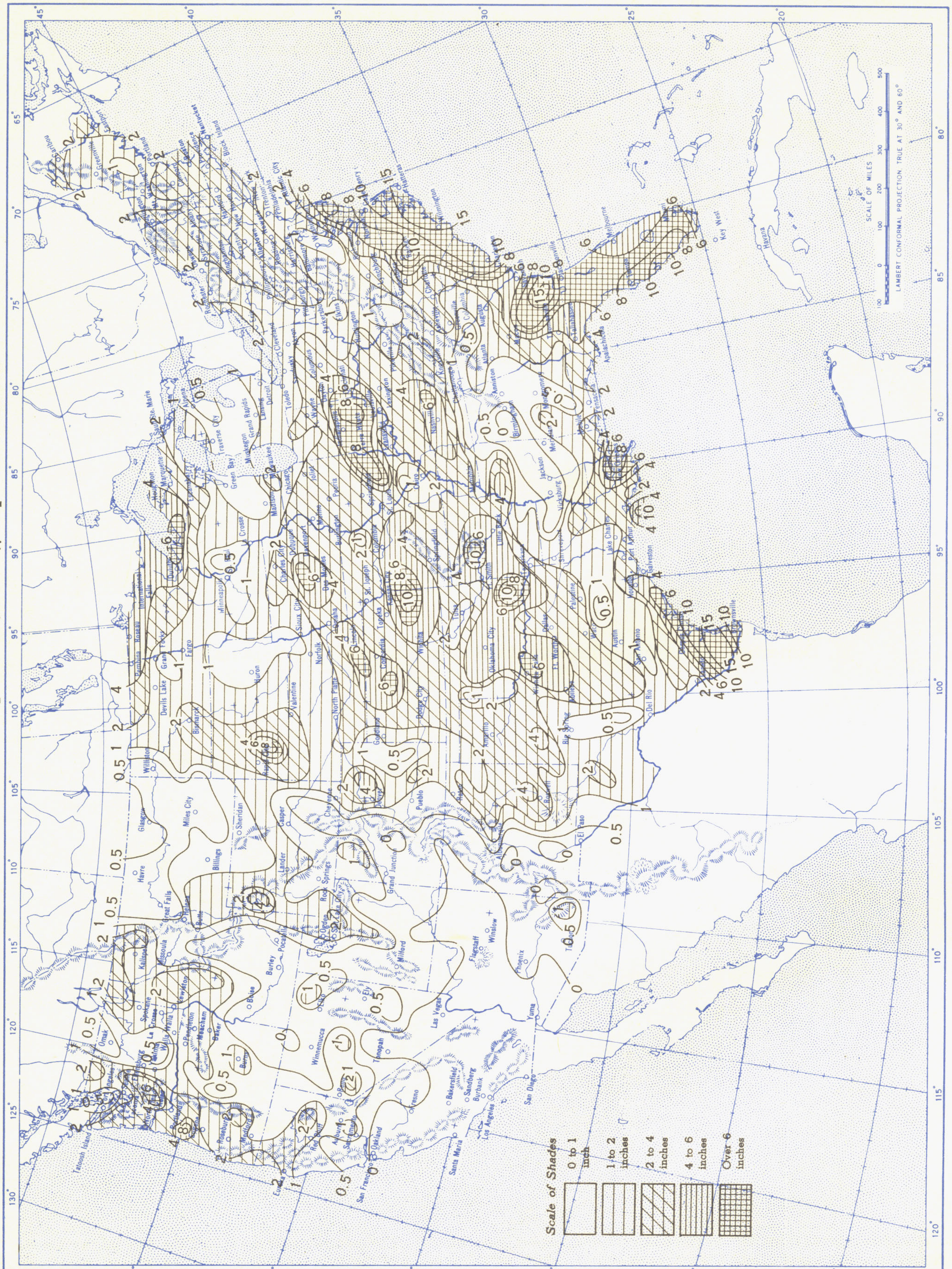


B. Departure of Average Temperature from Normal (°F.), September 1955.



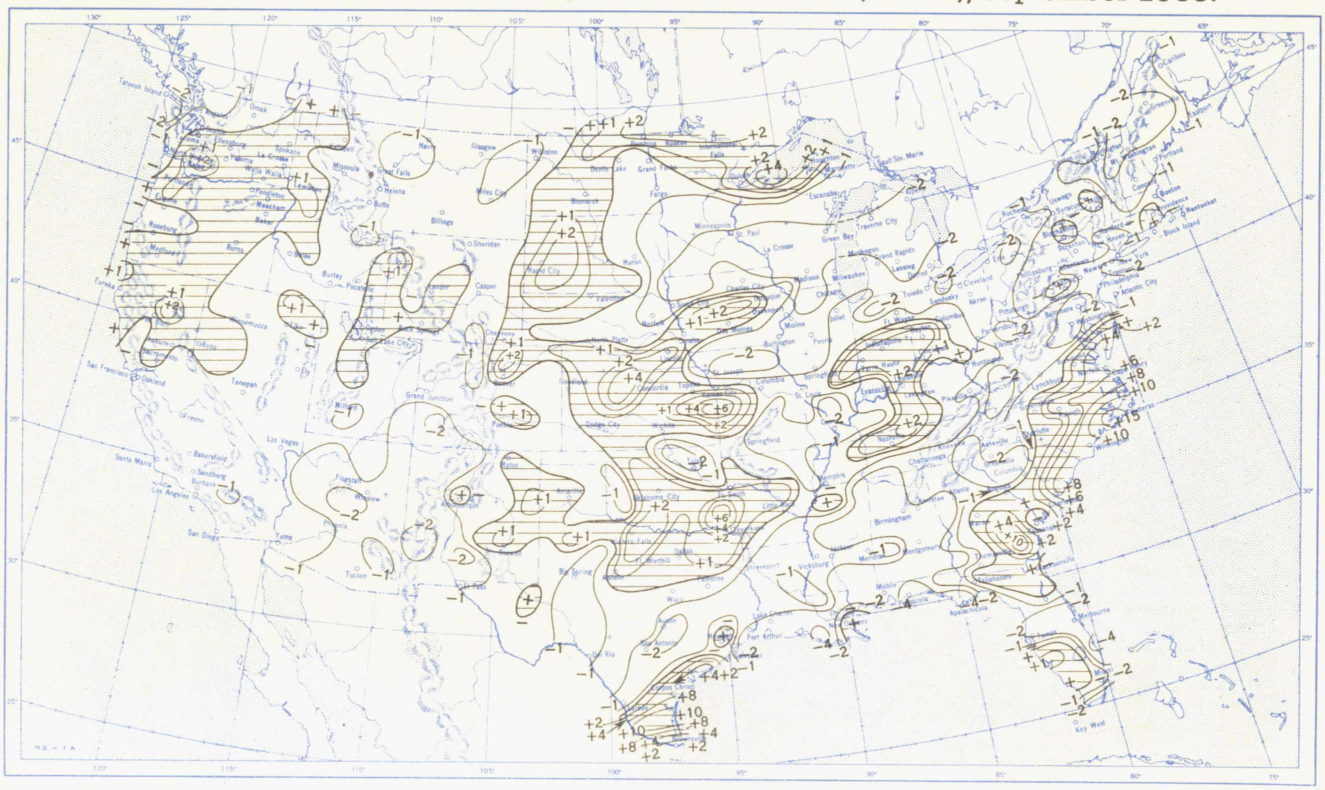
A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

Chart II. Total Precipitation (Inches), September 1955.

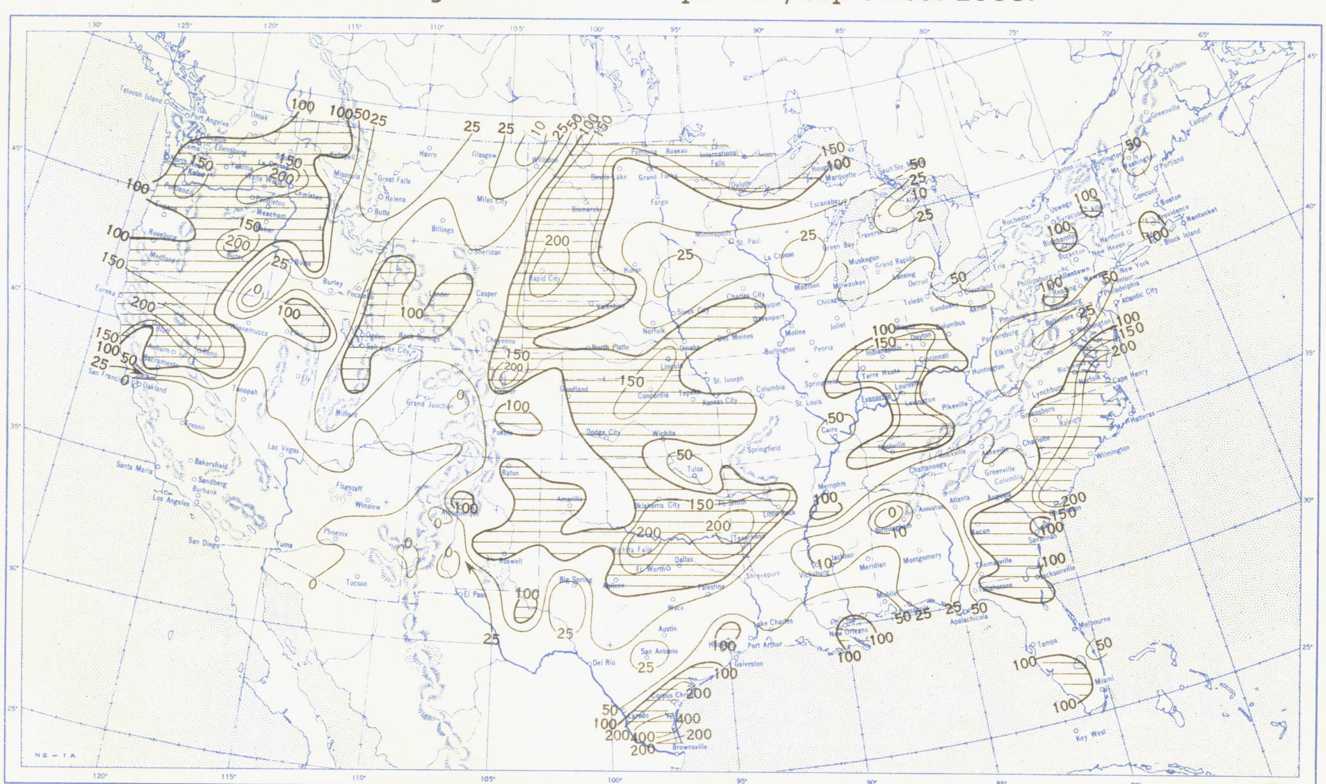


Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), September 1955.

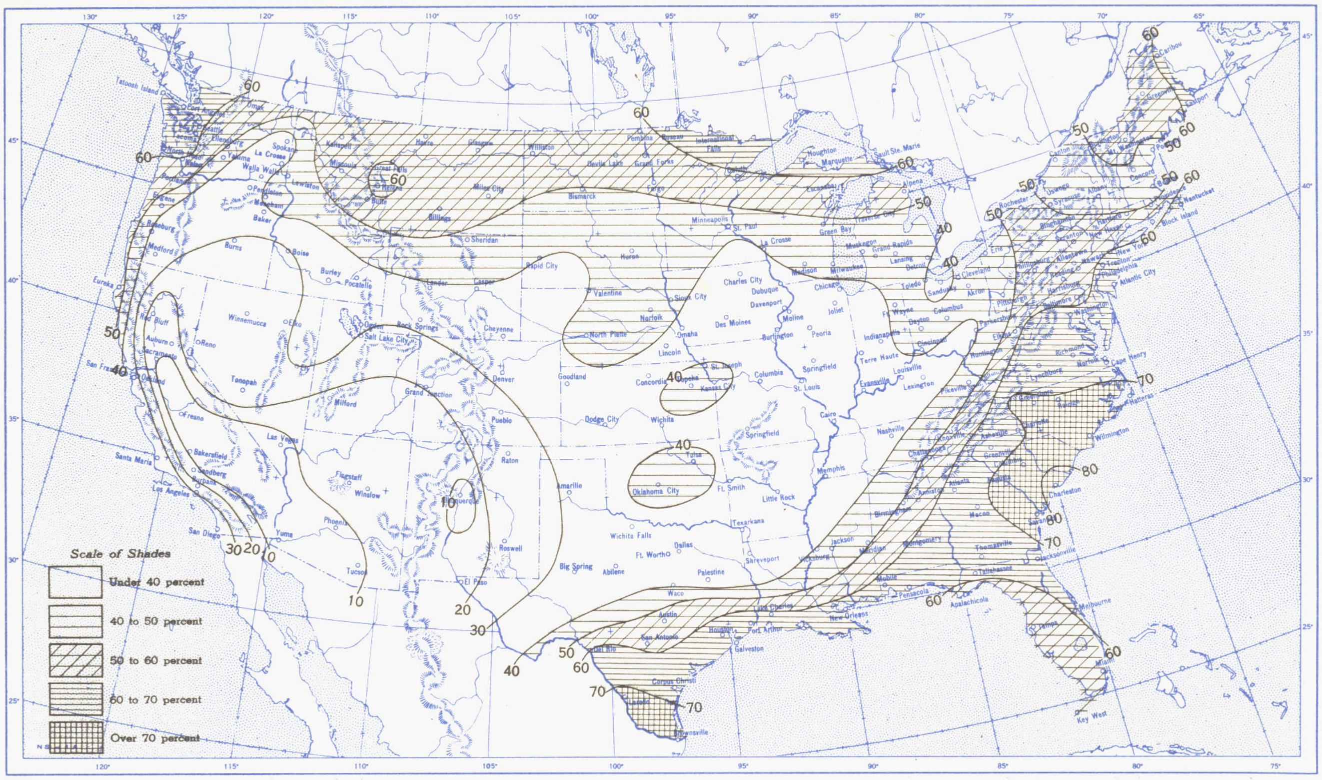


B. Percentage of Normal Precipitation, September 1955.

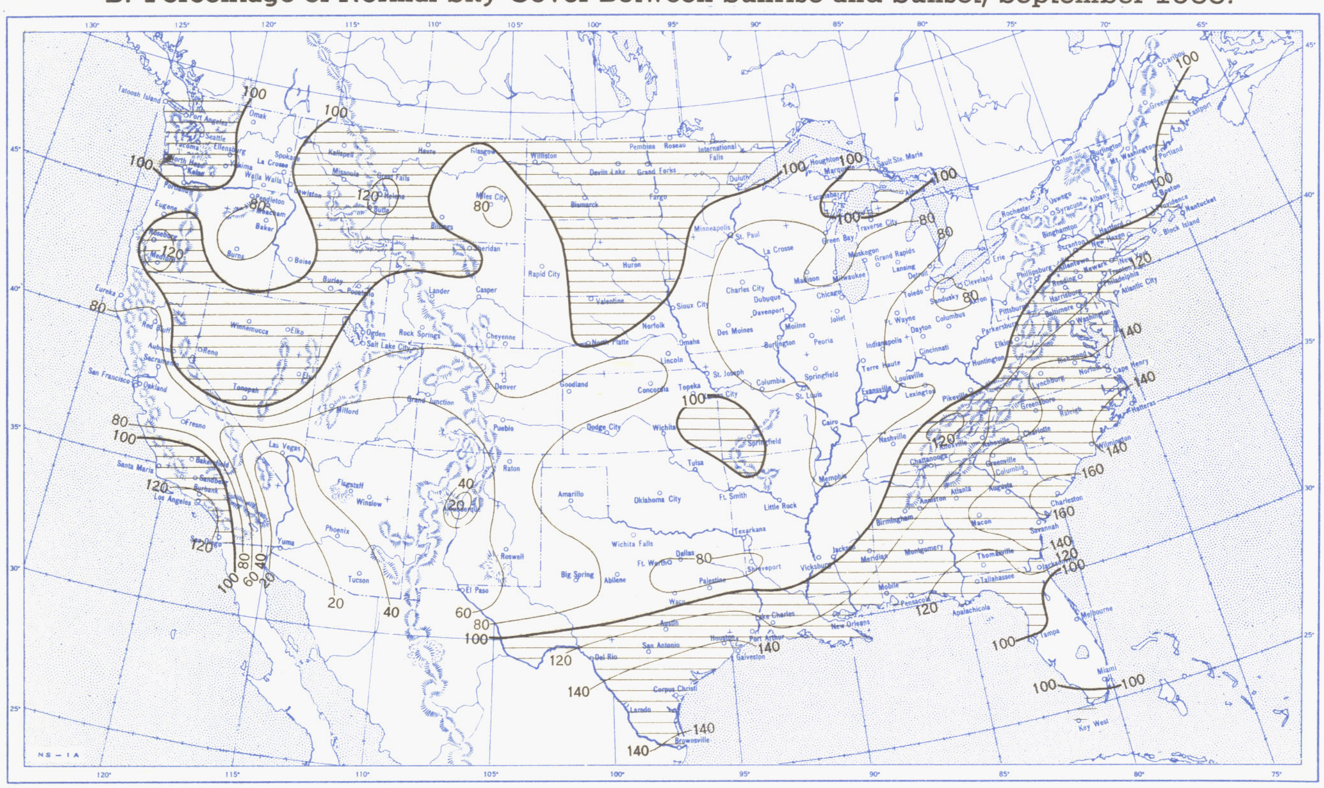


Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, September 1955.

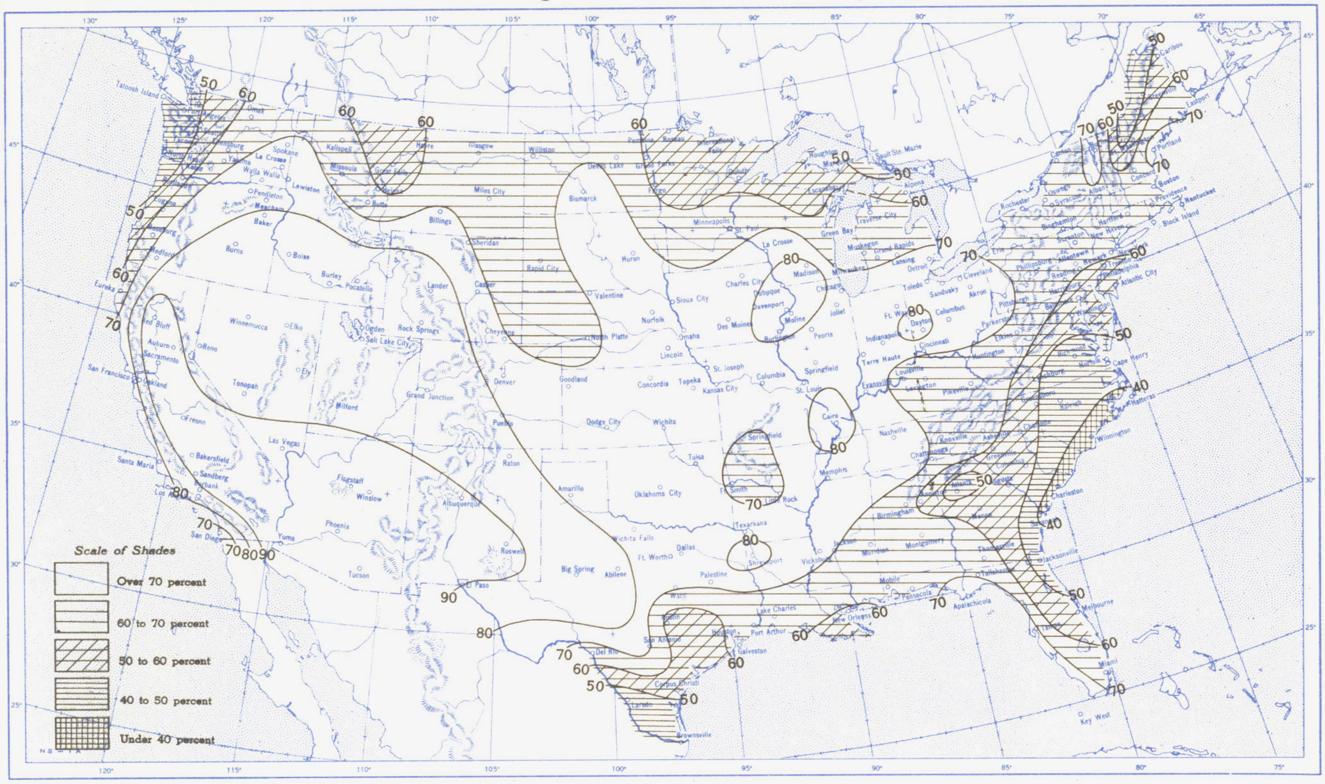


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, September 1955.

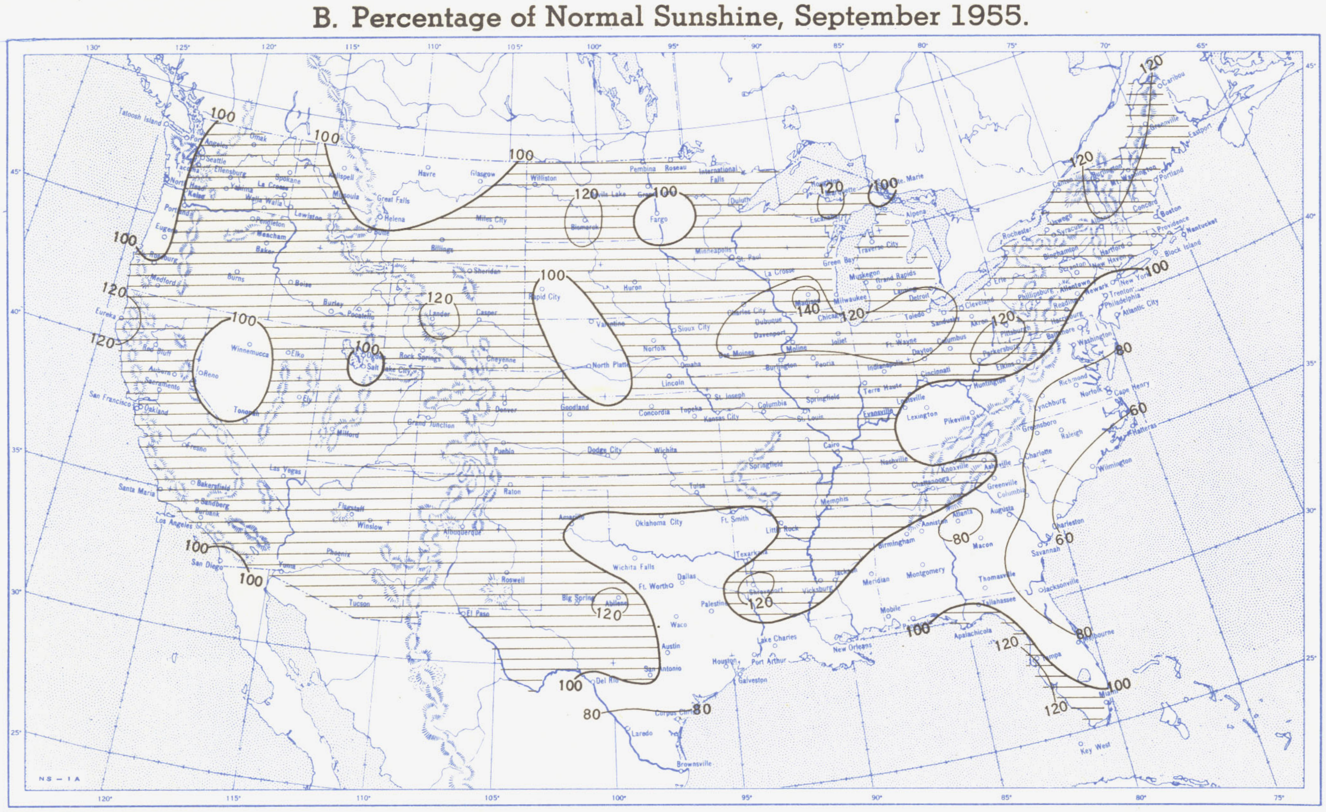


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, September 1955.

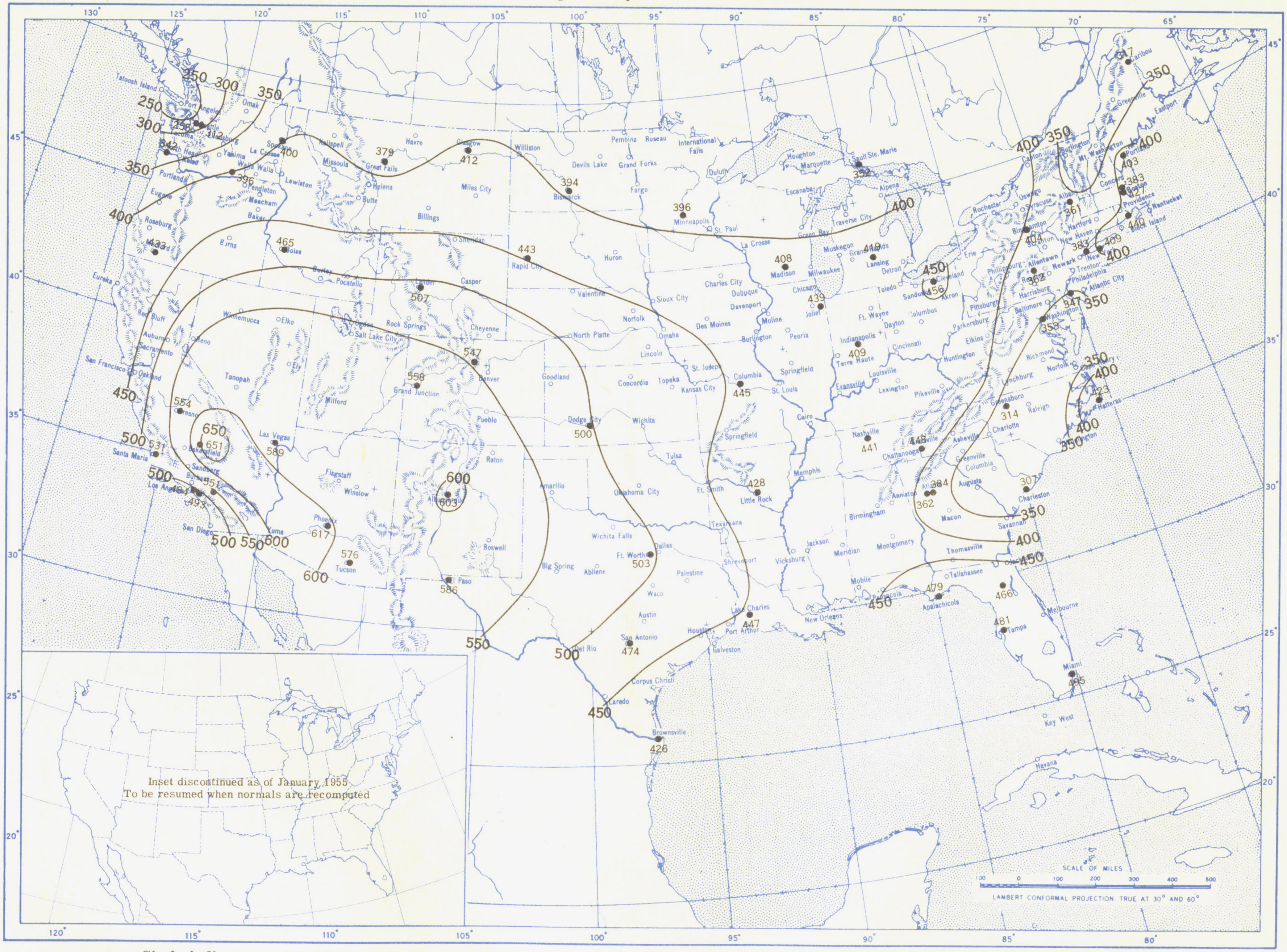


B. Percentage of Normal Sunshine, September 1955.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, September 1955. Inset: Percentage of Normal Average Daily Solar Radiation.



Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, September 1955.

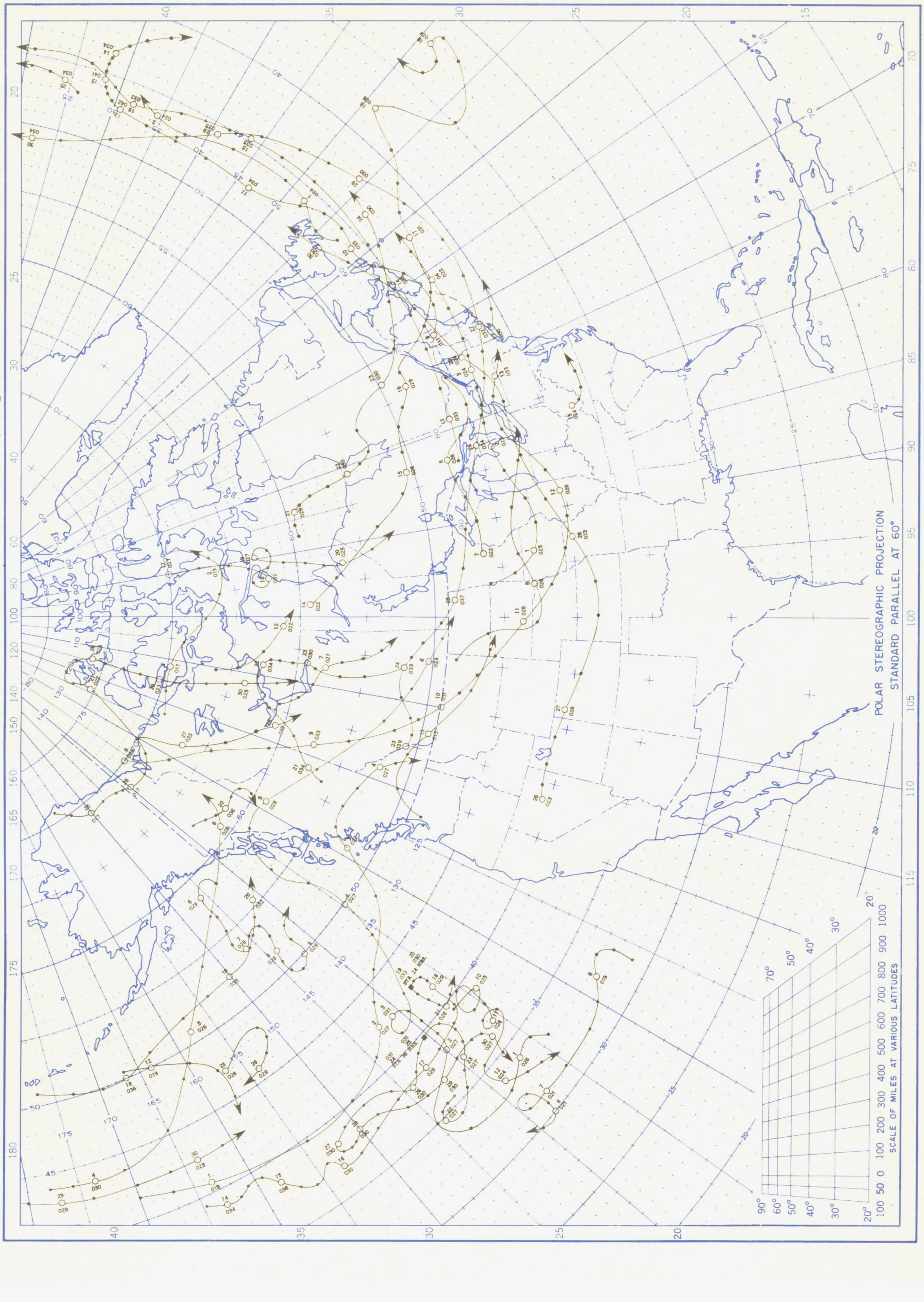
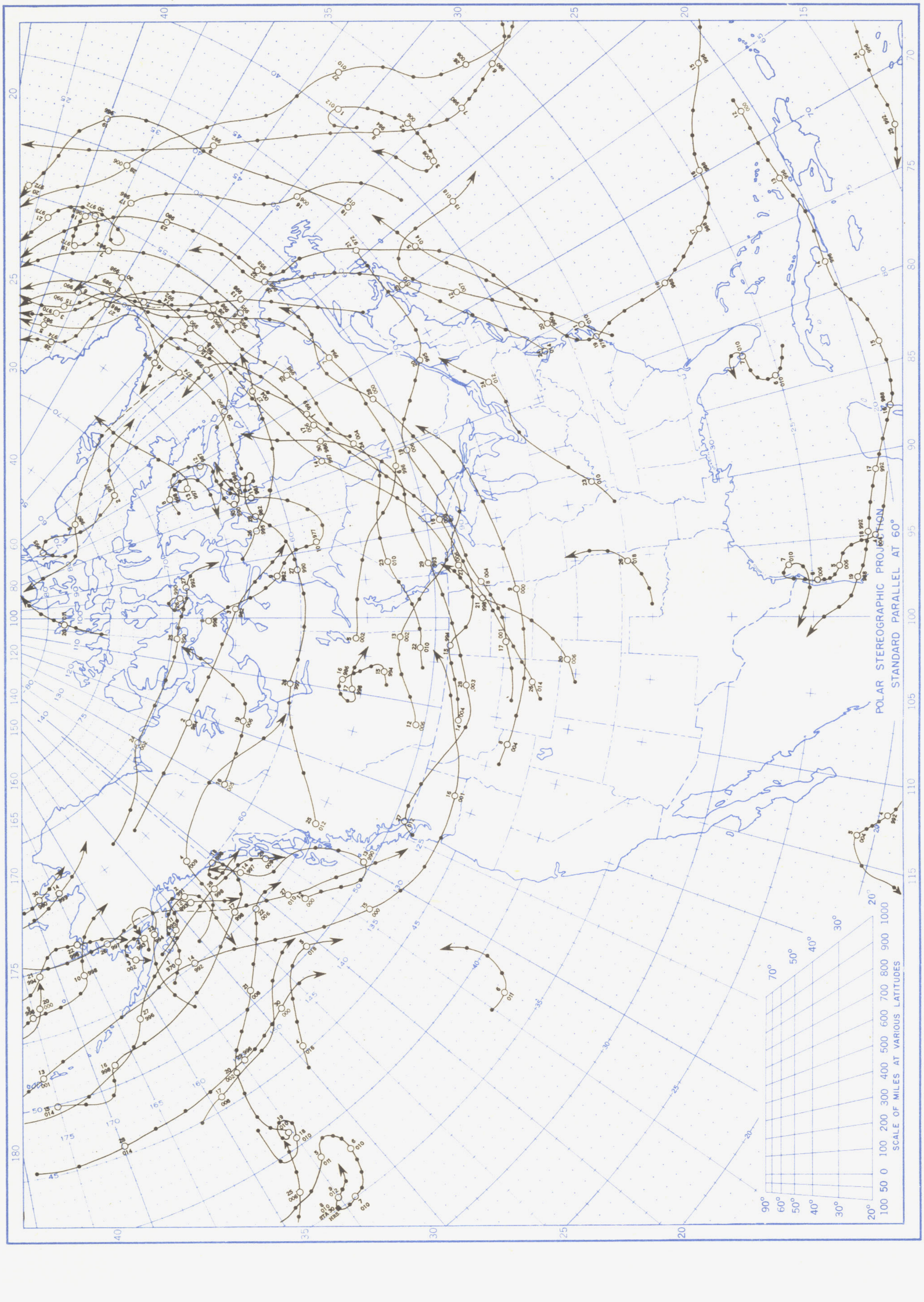


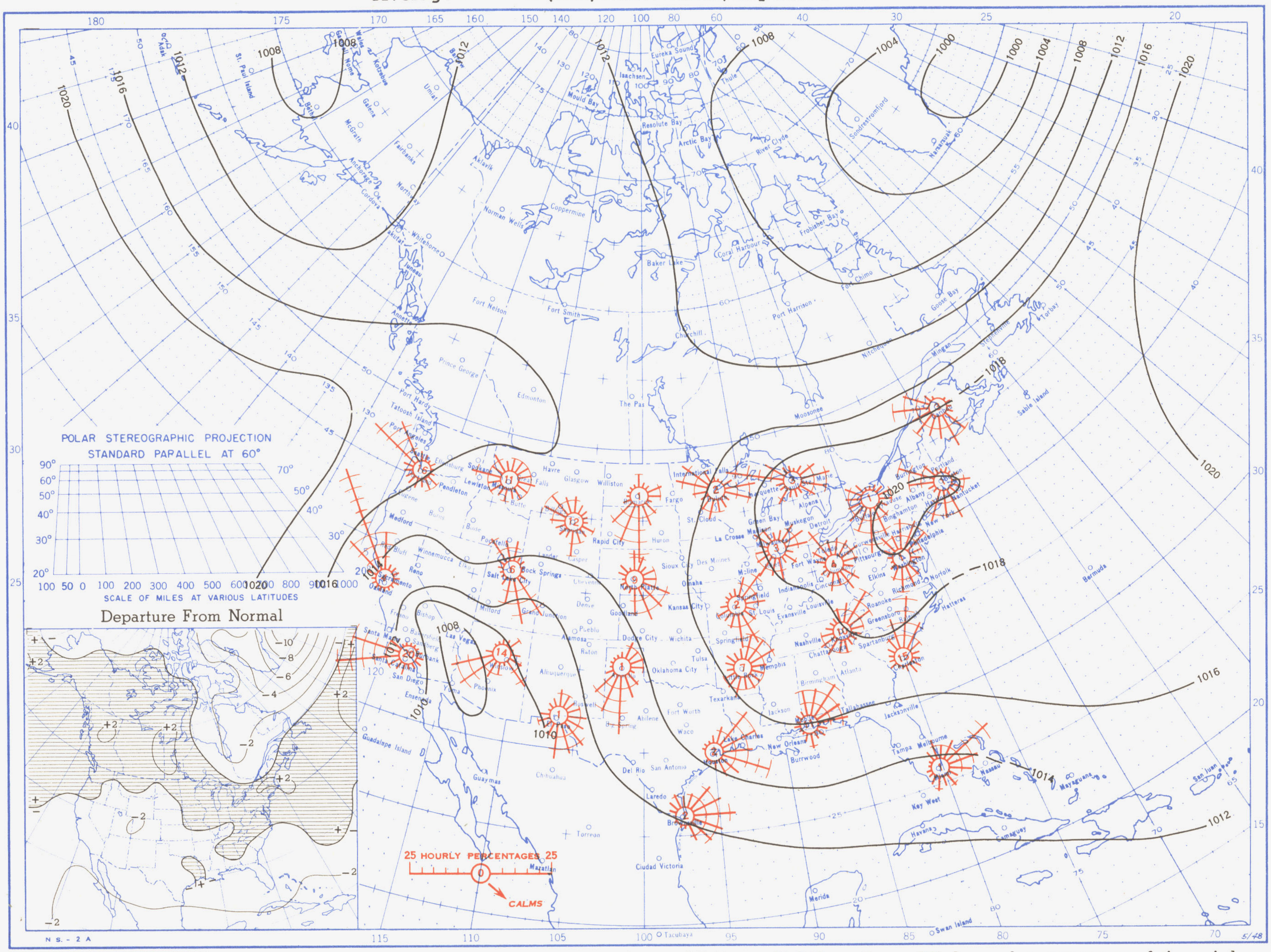
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown.

Chart X. Tracks of Centers of Cyclones at Sea Level, September 1955.



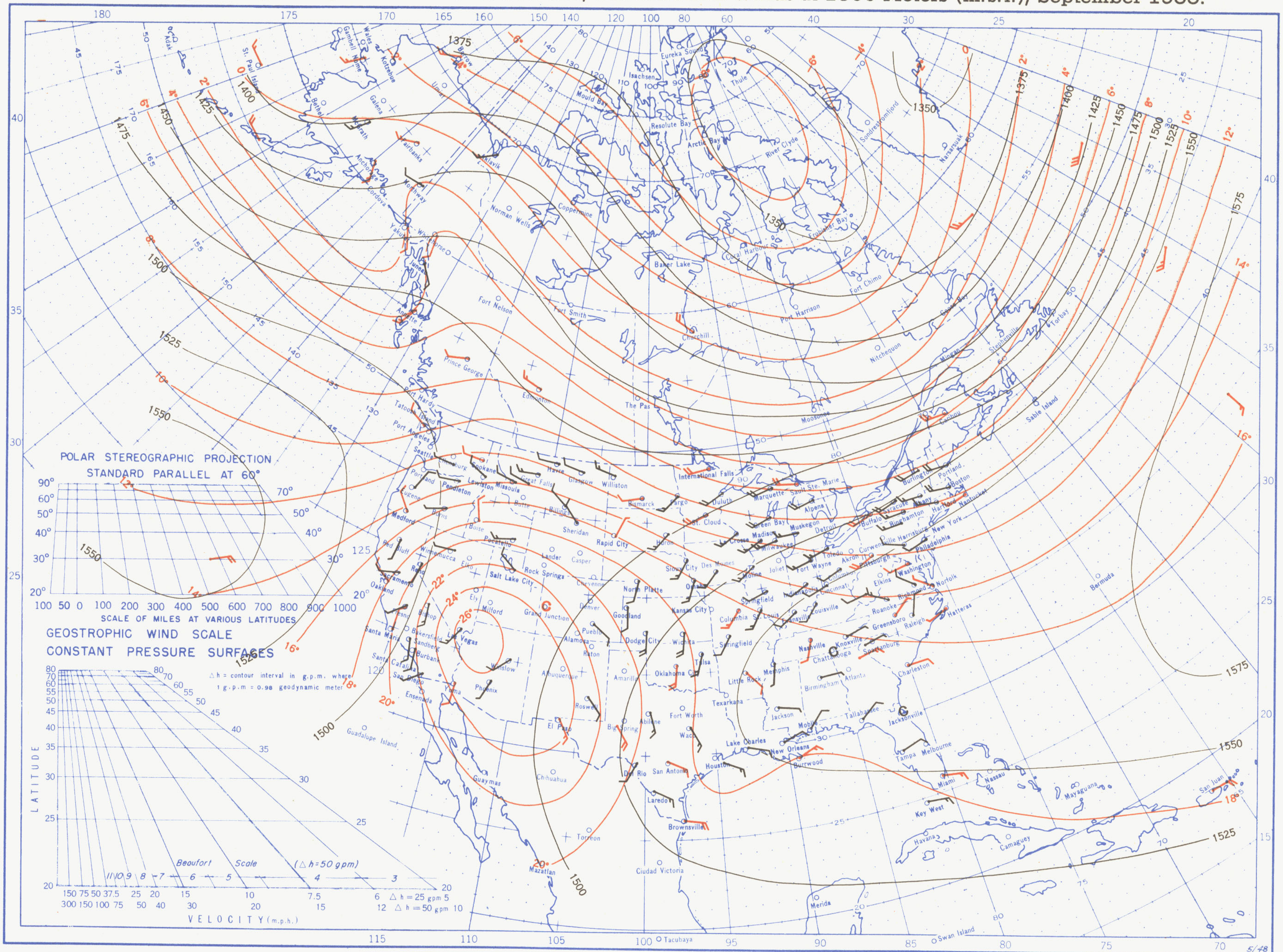
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, September 1955. Inset: Departure of Average Pressure (mb.) from Normal, September 1955.



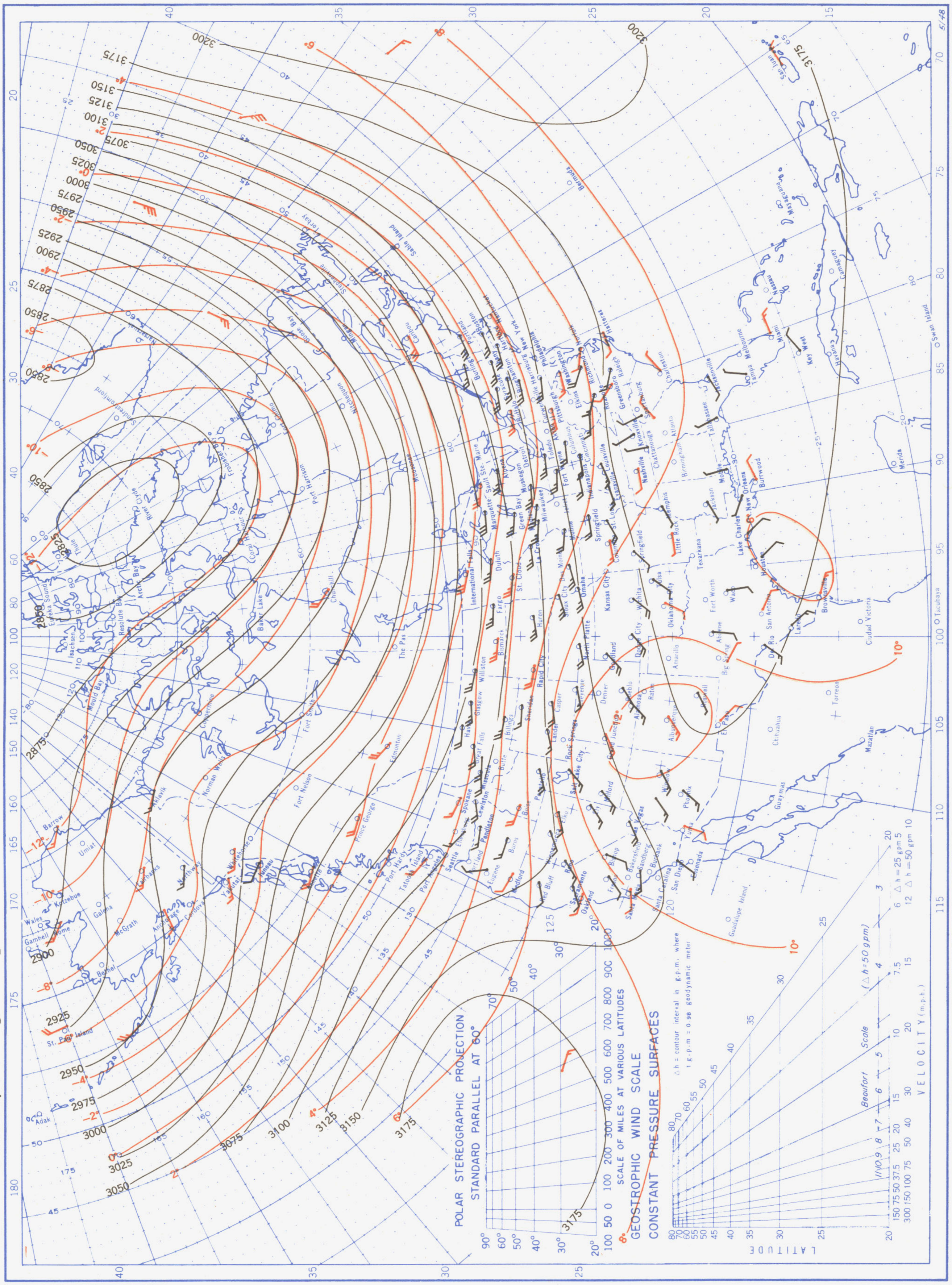
Average sea level pressures are obtained from the averages of the 7:30 a.m. and 7:30 p.m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), September 1955.



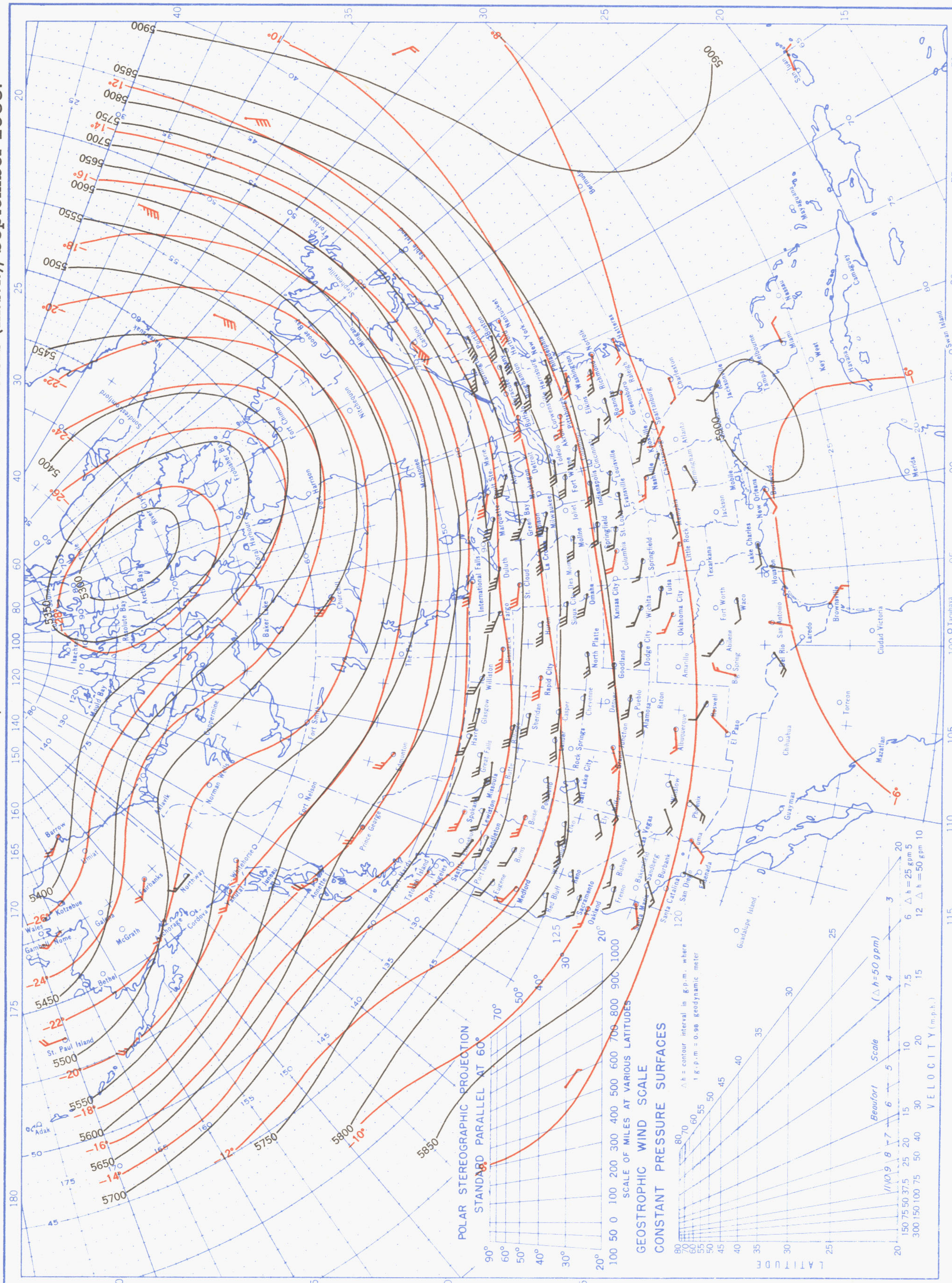
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m.. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), September 1955.



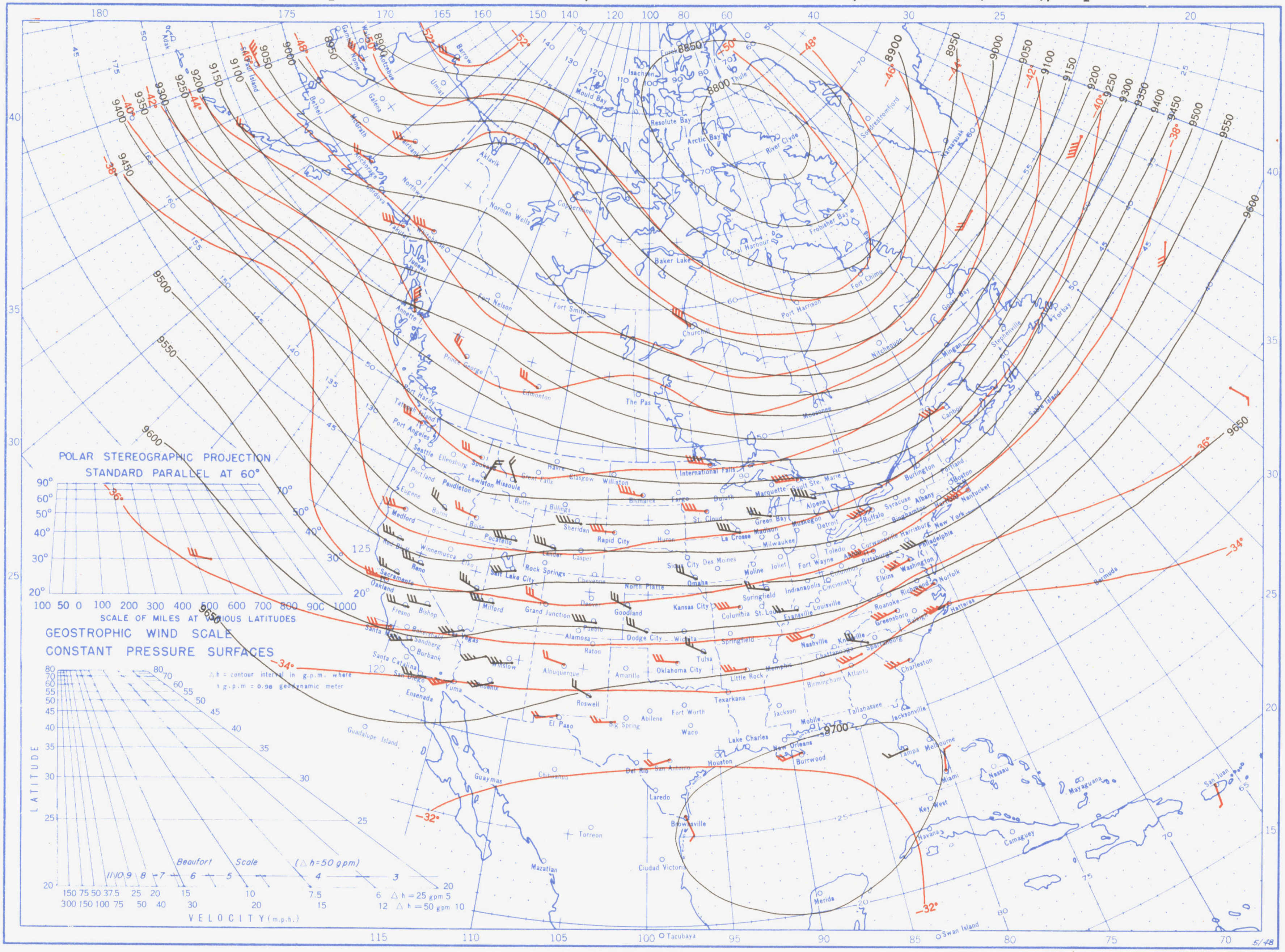
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), September 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), September 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.